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AIRCRAFT PRODUCTION TECHNOLOGY

An Algorithm for Calibrating the Three-Axis Magnetometer

L. Yu. Emaletdinova[a], A. V. Gainutdinova[b] , and T. Yu. Gainutdinova[c, *]

[a]*Tupolev Kazan National Research Technical University, ul. Karla Marksa 10, Kazan, 420111 Tatarstan, Russia*

[b]*ICL-KME CS, Sibirskiy Trakt 34, Kazan, 420029 Tatarstan, Russia*

[c]*Kazan (Volga region) Federal University, ul. Kremlyovskaya 18, Kazan, 420008 Tatarstan, Russia*

**e-mail: tgainut@mail.ru*

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Abstract—A three-step computational technique for calibrating the magnetometers is proposed based on the functional minimization by means of a discrete Newton algorithm. A comparative analysis reveals that the technique proposed allows us to correct the data necessary for determining the azimuth by the Earth's magnetic field.

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Contemporary miniature three-axis magnetometers and accelerometers are well suited to portable navigation application and are the important built-in units of many inertial navigation systems. Conventional inertial navigation systems comprise in addition to the angular rate sensors, the three-axis accelerometers and magnetometers and they are used in automatic control systems of unmanned aerial vehicles combined with satellite navigation systems [1].

A primary task of all navigational calculations is to collect reliable sensor data on the parameters of vector fields (gravitational or magnetic one as in our case). The degree of confidence in the data obtained can be defined by certain geometry clauses [2]. For example, three reliable values of the ideal three-axis magnetometer should satisfy the sphere equation

$$\frac{x^2}{r^2}+\frac{y^2}{r^2}+\frac{z^2}{r^2}=1, \tag{1}$$

where r is the sphere radius.

If three complete rotations relative to three axes of an ideal three-axis magnetometer (Fig. 1) are performed, we will get the data that is shown in Fig. 2a. The factory calibrating characteristics of magnetometers are not sure remained under service conditions different from the factory ones (Fig. 2b).

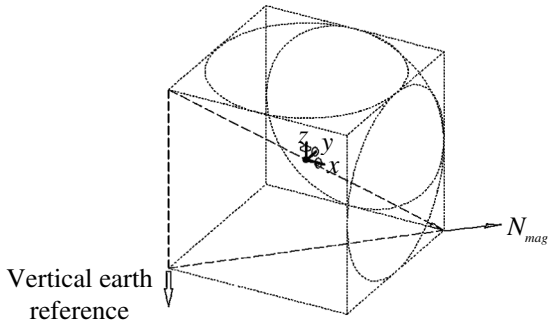

Fig. 1. An ideal three-axis magnetometer.